

Changing Patterns in the Incidence of Esophageal and Gastric Carcinoma in the United States

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As indicated in the article, rates for earlier years have been presented previously, but this is the first time the data have been extended through 1994.

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BACKGROUND. Incidence rates for esophageal adenocarcinoma previously were reported to be increasing rapidly, especially among white males. Rates for gastric cardia adenocarcinoma also were observed to be rising, although less rapidly. In this article, the authors update the incidence trends through 1994 and further consider the trends by age group.

METHODS. Surveillance, Epidemiology, and End Results (SEER) program data were used to calculate age-adjusted incidence rates for esophageal carcinoma by histologic type and gastric adenocarcinoma by anatomic subsite.

RESULTS. Among white males, the incidence of adenocarcinoma of the esophagus rose > 350% since the mid-1970s, surpassing squamous cell carcinoma around 1990. Rates also rose among black males, but remained at much lower levels. To a lesser extent, there were continuing increases in gastric cardia adenocarcinoma among white and black males, which nearly equaled the rates for noncardia tumors of the stomach in white men. The upward trend for both tumors was much greater among older than younger men. Although the incidence also rose among females, rates remained much lower than among males.

CONCLUSIONS. Previously reported increases of esophageal adenocarcinoma are continuing, most notably among white males. Cigarette smoking may contribute to the trend through an early stage carcinogenic effect, along with obesity, which may increase intraabdominal pressure and predispose to gastroesophageal reflux disease. Further research into esophageal and gastric cardia adenocarcinoma is needed to clarify the risk factors and mechanisms responsible for the upward trends as well as the racial and gender disparities in incidence. *Cancer* 1998;83:2049-53. © 1998 American Cancer Society.

KEYWORDS: esophagus, stomach, neoplasms, adenocarcinoma, squamous cell carcinoma.

We previously reported that the incidence rates for adenocarcinoma of the esophagus have risen rapidly in the U.S., especially among white males.^{1,2} To a lesser extent, rates for adenocarcinoma of the gastric cardia also are rising, and appear to share epidemiologic features with esophageal adenocarcinoma. In this article we update the trends with four additional recent years of data, with further analyses by age group.

METHODS

Population-based incidence data were available from the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) program.³ We calculated age-adjusted (1970 U.S. standard) incidence rates for the 7 3-year time periods beginning in 1974-1976 and extending through 1992-1994, the last period with available data. Race specific and gender specific rates were calculated for esophageal

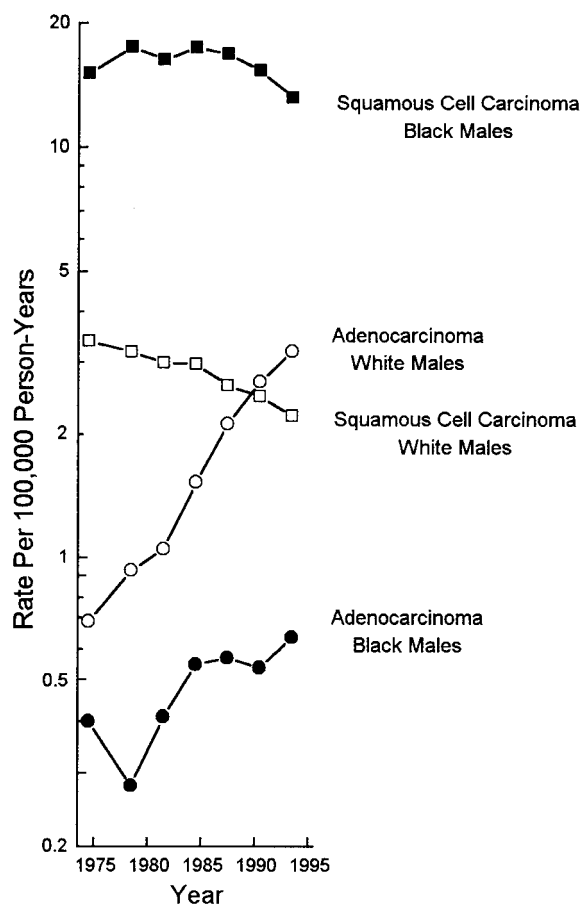


FIGURE 1. Trends in age-adjusted incidence rates for esophageal carcinoma among U.S. males by race and cell type, 1974–1976 to 1992–1994.

carcinoma by histologic type and for gastric adenocarcinoma by anatomic subsite. The site and type categories were formed based on International Classification of Diseases for Oncology (ICD-O) (2nd edition) codes⁴: esophagus (C15.0–C15.9), gastric cardia (C16.0), other specified stomach sites (C16.1–C16.6), stomach subsite not specified (C16.8–C16.9), squamous cell carcinoma (8050–8082), adenocarcinoma (8140–8573), and all other (excluding lymphomas) (8000–8045, 8090–8130, 8580–9581). We also calculated rates for 4 age groups (< 55 years, 55–64 years, 65–74 years, and 75+ years), age-adjusted within these groups.

RESULTS

Among white males, the incidence of esophageal adenocarcinoma now has surpassed that of squamous cell carcinoma (Fig. 1). The annual rates per 100,000 population for adenocarcinoma rose from 0.7 during 1974–1976 to 3.2 during 1992–1994, an increase of > 350%. The corresponding numbers of cases rose

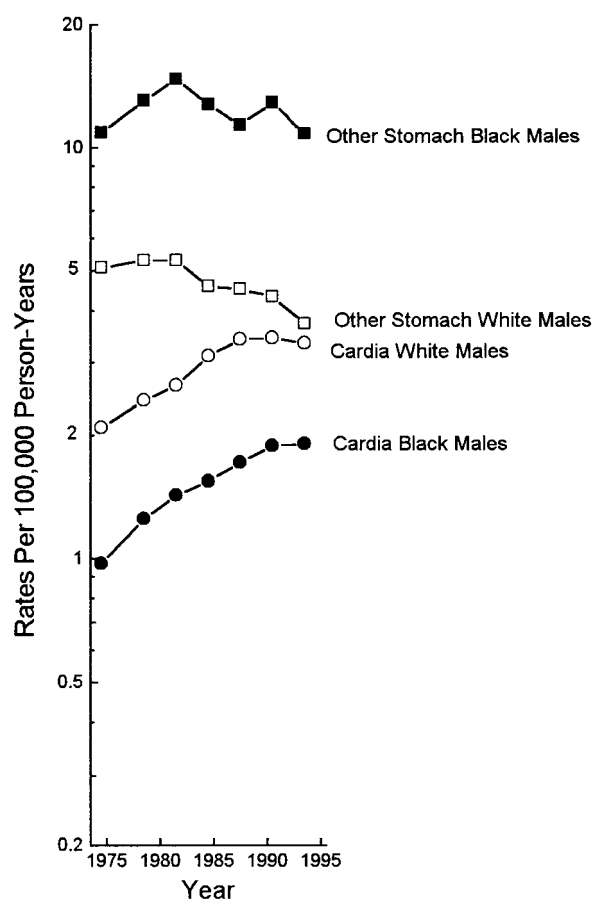


FIGURE 2. Trends in age-adjusted incidence rates for gastric adenocarcinoma among U.S. males by race and anatomic subsite, 1974–1976 to 1992–1994.

from 164 to 934. During the same period, the rates for squamous cell carcinoma of the esophagus declined from 3.4 to 2.2, based on 772 and 642 cases, respectively.

Among black males, increases were apparent for esophageal adenocarcinoma, with rates increasing from 0.4 to 0.6, although based on only 7 and 16 cases, respectively. The rates for squamous cell carcinoma among black males continued to decline into the 1990s, but remained much higher (13.2) than the figures for esophageal adenocarcinoma.

Although less dramatic, increases in adenocarcinoma of the gastric cardia were observed in both white males (2.1 to 3.3) and black males (1.0 to 1.9), as shown in Figure 2. Rates for adenocarcinoma arising in other specified parts of the stomach did not change consistently among black males, but declined from 5.1 to 3.7 among white males. Among white males the rise in the incidence of gastric cardia adenocarcinoma appears to have reached a plateau, although by 1992–1994 the rate for adenocarcinoma of the gastric cardia

TABLE 1
Ratios of Age-Adjusted Rates of Esophageal and Gastric Cardia
Adenocarcinoma among White Males in 1981–1987 and 1988–1994
Relative to 1974–1980 According to Age

Cancer	Age (yrs)	1974–1980	1981–1987	1988–1994
Esophageal adenocarcinoma	< 55	1.0	1.4	2.3
	55–64	1.0	1.3	2.3
	65–74	1.0	2.4	4.5
	75+	1.0	2.0	3.8
	Total	1.0	1.9	3.4
Gastric cardia adenocarcinoma	< 55	1.0	1.1	1.2
	55–64	1.0	1.3	1.4
	65–74	1.0	1.4	1.6
	75+	1.0	1.5	1.8
	Total	1.0	1.3	1.5

nearly equaled the rate for tumors arising in other parts of the stomach.

The increasing trends for esophageal and gastric cardia adenocarcinomas varied by age, being more pronounced among older men. Table 1 lists ratios of rates across three calendar periods for white males only because small numbers precluded further age specific analyses by race or gender. Below age 65 years the rates for esophageal adenocarcinoma doubled, whereas the rates for gastric cardia adenocarcinoma increased by 20%. In contrast, above age 65, there were threefold to fourfold increases in esophageal adenocarcinoma and a 60% increase in gastric cardia adenocarcinoma.

Age-adjusted rates for esophageal and gastric cardia adenocarcinomas rose among white females from 0.1 to 0.4 and 0.3 to 0.6, respectively, although the figures remained much lower than among males. Meanwhile, rates for esophageal squamous cell carcinoma were fairly constant whereas rates for noncardia adenocarcinoma declined. Among black females, the low rates for esophageal and gastric cardia adenocarcinomas were too unstable to evaluate trends reliably.

DISCUSSION

Since our first report based on SEER program data from the 1970s through 1987,¹ which subsequently was updated through 1990,² we find that the recent data through 1994 document continuing marked increases in the incidence of esophageal adenocarcinoma in the U. S., such that adenocarcinoma currently is the dominant form of esophageal carcinoma among white males. The reasons are not readily apparent, but the possibility of diagnostic shifts should be considered. Because tumors arising in the cardioesophageal junction are classified with gastric cardia

tumors,⁴ an increase in esophageal adenocarcinoma could appear if tumors at or near the junction were identified increasingly as being esophageal in origin. However, gastric cardia rates then would diminish to a similar extent, which has not occurred. The rates for gastric carcinoma of other specified sites and for carcinoma without a subsite specified have both declined. Whether the latter decline is related to improving subsite specificity, which may have contributed to the increases in gastric cardia cases, or to real declines in distal gastric carcinoma cannot be determined. An upward trend in esophageal adenocarcinoma also may result from improved specificity of the cell type, but among white males the increases exceed declines in squamous cell and other carcinomas. Rates may increase with earlier endoscopy-based diagnoses, but the stage distribution has not changed over time, and survival consistently has been poor, even for patients diagnosed with localized disease.⁵ These observations suggest that the increases in incidence rates are real and reflect changes in the prevalence of risk factors. Rates also have been increasing in the United Kingdom, Scotland, Scandinavia, France, Switzerland, Australia, and New Zealand.^{6–15}

Case-control studies of patients with esophageal or gastric cardia adenocarcinoma have suggested cigarette smoking and possibly heavy liquor consumption as risk factors, although not to the extent observed for squamous cell carcinoma of the esophagus.^{16–22} Smokers experience approximately a twofold to threefold increase in the risk of esophageal adenocarcinoma, but it appears that risk does not decrease substantially after cessation of smoking^{17,18,22} as it does for esophageal squamous cell carcinoma, suggesting an early stage effect for adenocarcinoma and a late stage effect for squamous cell carcinoma. In the largest such study,²² the risk of esophageal and gastric cardia adenocarcinoma among former smokers remained elevated until nearly 30 years after cessation of smoking.

It is noteworthy that the prevalence of cigarette smoking in the U.S. rose dramatically in the first two-thirds of this century, before declining by at least 33% among men between the early 1970s and the early 1990s.²³ The rising trend in smoking into the 1960s coincides with the subsequent increases in esophageal adenocarcinoma into the 1990s among older adults. However among those age < 50 years, the downward trends in smoking prevalence from the 1960s to the 1990s have not yet resulted in decreasing rates of esophageal adenocarcinoma.

Thus it is possible that patterns of smoking have influenced the changing incidence of both adenocarcinoma and squamous cell carcinoma of the esophagus. The rising prevalence up to the 1960s in smoking,

affecting the early stages of the carcinogenic process for adenocarcinoma, may have contributed to its increase, especially in older adults. In contrast, declines since the 1960s in the prevalence of smoking, affecting the late promotional stages of carcinogenesis for squamous cell carcinoma, may have contributed to its recent decrease. These trends in smoking also may have influenced the racial and gender differences in incidence for each cell type. It is not clear whether alcohol consumption is related to the risk of adenocarcinoma, but in the general population alcohol intake has not increased²³ and thus appears unlikely to have affected the trends.

In recent years, obesity has emerged as a major risk factor for these tumors.^{19,24,25} The percentage of adults in the population who are overweight increased slightly between the early 1960s and the late 1970s (from 24% to 25%), but has risen considerably since then (to > 33% in recent years).^{23,26} The mechanism by which obesity predisposes to esophageal adenocarcinoma may be through increasing intraabdominal pressure and the subsequent risk of gastroesophageal reflux disease and its progression to the metaplastic precursor state of Barrett's esophagus.²⁷⁻³⁰ There is some evidence that dietary factors also may be involved, including low intake of fruits and vegetables, and high intake of red meat, fat, and calories.^{24,31-33} However, further research is needed to elucidate the array of risk factors and causal mechanisms underlying the upward trend in esophageal and gastric cardia adenocarcinomas, as well as the racial and gender disparities in incidence.

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